

Best Management Practices

Distribution System Cleaning/ Uni-directional Flushing

Developed by



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for



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Distribution System Cleaning/Uni-directional Flushing

Your water distribution system—whether large or small—requires regular cleaning to guarantee your customers have safe, aesthetically pleasing water. It's important, therefore, to understand water quality degradation and to develop appropriate response strategies.

What is water distribution system cleaning?

As explained in *Water Quality in Distribution Systems: A Best Practice by the National Guide to Sustainable Municipal Infrastructure*, distribution system cleaning is “any program, technology, process, operating method or management practice that reduces or prevents water quality degradation in a water system or receiving environment.” These include flushing, swabbing, and pigging to remove biofilms, sediment, and corrosion by-products from water main interiors, which generally improves water quality and hydraulic capacity.

Pipes should be flushed spring and/or fall to maintain water quality, maximize hydraulic capacity, and remove stagnant water at dead ends, and in response to non-compliant samples or customer complaints. The guide recommends **uni-directional flushing**, which isolates pipe sections or loops in an organized, sequential manner, typically from source to periphery. Flow velocities should reach 1.5 to 2.0 m/s. While more costly and time consuming than conventional flushing, uni-directional flushing is more effective and uses less water.

In some cases (e.g. in mains larger than 300mm), it may be impossible to achieve the flow velocities required to adequately scour the pipes. **Swabbing** with soft foam swabs or **pigging** with wire brushes, scrapers or rigid plastic pigs can then be used to clean mains. Although pigging is more effective than flushing or swabbing, it requires considerable expertise, materials, and time.

As stated in the guide, “Water quality complaints should be monitored geographically. All municipalities should use some type of data management system to track these water quality complaints to optimize their flushing program. Larger municipalities (and smaller

Information Links

[*Water Quality in Distribution Systems: A Best Practice by the National Guide to Sustainable Municipal Infrastructure*](#)
(PDF File)

municipalities with significant water quality problems) should use a GIS system to track complaints and analyze monitoring data.

“Computer models can be used to simulate the water age and disinfectant residuals throughout a distribution system. This information can then be used to identify the areas that require more frequent flushing. Computer models can also be used to identify flushing sequences (based on the uni-directional flushing method) and the expected flushing velocity for each section of the water main.”

Why should BMPs be applied to distribution system cleaning/uni-directional flushing?

A distribution system cleaning program that reflects BMPs:

- **increases protection of potable water supply;**
- **reduces risk to public health;**
- **improves aesthetics of water;**
- **ensures compliance with operating permits;**
- **reduces disinfection demand;**
- **improves hydraulic capacity;**
- **improves chlorine residuals;**
- **reduces sedimentation/turbidity;**
- **reduces re-growth/biofilm;**
- **improves hydrant efficiency; and**
- **reduces operational costs.**

A distribution system cleaning program that reflects BMPS also helps build consistency throughout the province.

What BMPs should be applied to small systems?

Small water systems (e.g. those servicing a trailer park or subdivision) can implement a distribution system-cleaning program that includes the following steps:

Uni-directional Flushing

1. Research other successful uni-directional flushing (UDF) programs implemented by other small systems.
2. Monitor water distribution system quality regularly (e.g. chlorine residuals, turbidity, total coliforms).
3. Review existing system for location of flush-out locations and install new ones where necessary.
4. Review drainage and dechlorination requirements (e.g. dechlorinate all waters that may enter a water course).
5. Develop a UDF program that includes hydrant maintenance and valve exercising (prepare maps, record forms, emergency responses, etc.).
6. Obtain (purchase, rent, or borrow) the necessary equipment (e.g. flow gauge, energy dissipater, turbidity meter).
7. Notify customers in advance of possible impacts, duration, etc.
8. Notify fire department (if applicable) of reduction in fire flow.
9. Begin UDF program by cleaning your reservoir (if applicable).
10. Conduct UDF program every six months to three years unless otherwise advised by your Drinking Water Officer (for seasonal systems conduct at the start of each season).
11. Conduct post-flushing water quality monitoring.
12. Document results and update records and procedures.

Spot Flushing

1. Spot flush water system at all dead ends and other locations in response to low chlorine residuals, failed bacteriological tests, or customer complaints

Swabbing/Pigging

1. If you have pipes that cannot be cleaned by UDF, contact a qualified professional to review the risks, benefits, and costs of swabbing or pigging

What BMPs should be applied to larger systems?

1. Conduct Initial Research

- Consult with Drinking Water Officer (DWO)
- Consult with federal Department of Fisheries and Oceans and provincial Ministry of Water, Land and Air Protection regarding discharges
- Research materials from AWWA, BCWWA, and CSA
- Research successful distribution cleaning programs in other communities
- Conduct benefit analysis of various options (uni-directional flushing vs. pigging)

2. Build Program Framework

- Identify objectives and targets

- Identify manpower/training requirements and resources
- Identify equipment needs
- Outline a systematic approach (e.g. uni-directional flushing with spot flushing for water quality incidents)
- Prepare budget
- Set schedule according to local conditions
- Prepare business plan
- Evaluate and refine plan (ongoing)

3. Garner Support and Funding

- Present business plan to senior staff and council or board (include regulatory

If you need help...

Small Systems

- **Coastal Water Suppliers Association**

Pauline Berkman
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- **Small Water Users Association**

Denny Ross-Smith
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- **Water Supply Association of BC**

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requirements/recommendations, recommended approach, and funding requirements)

- Provide frequent updates (ongoing)

4. Develop Technical Plan

- Consider regulatory requirements (e.g. health authority, DFO, MWLAP, local jurisdictions)
- Communicate with regulatory agencies
- Develop approach (e.g. by area or total system)
- Determine sequence (e.g. reservoir, pump stations, wet wells, water mains)
- Identify potential challenges (e.g. specific locations, pipe types)
- Utilize available tools to help develop plan (e.g. computer model)
- Develop policies and procedures (e.g. flow and velocity, sequence)
- Set timeline

5. Develop Water Discharge Plan

- Incorporate regulatory requirements

6. Create Communications Plan and Materials

- Identify internal and external audiences' specific communication needs
- Prepare a written plan, including emergency response procedures
- Educate all appropriate staff about uni-directional flushing, spot flushing, and pigging/swabbing
- Prepare staff for incoming calls during flushing (e.g. increased turbidity)
- Access/prepare information and education materials for external audiences, if appropriate
- Educate external audiences, if appropriate
- Evaluate and refine plan (ongoing)

7. Implement Program

- Notify all personnel involved and conduct field orientation
- Communicate program to customers (e.g. mailout, website, newspaper, signs)
- Conduct pre-flushing tests (e.g. pressure, pH, turbidity)
- Increase disinfection concentrations before and during flushing
- Coordinate demand and uni-directional flushing
- Coordinate schedule with fire department
- Undertake cleaning (e.g. reservoir, pump stations, wet wells, water mains)
- Conduct post-flushing testing

8. Record and Report Flushing Data

- Prepare field records (e.g. dates, times)
- Update as constructed (e.g. drawings)
- Report maintenance issues
- Prepare annual trends that demonstrate health of system
- Forward general info to health authority (e.g. system with data), upon request
- Evaluate and update procedures

If you need help...

Large Systems

- **Fernando King**
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Recommended Reading...

Unidirectional Flushing VHS or DVD

Edition, 2002

American Water Works Association

(303-794-7711) www.awwa.org

Investigation of Pipe Cleaning Methods

American Water Works Association No. 90938

(303-794-7711) www.awwa.org

Internal Corrosion of Water

Distribution Systems

American Water Works Association No. 90508

(303-794-7711) www.awwa.org

Establishing Site-Specific Flushing Velocities

AWWA Research Foundation No. 90964F

(303-794-7711) www.awwa.org